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(54) **VEHICLE FRONT END PANEL WITH HORN COVER**

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(52) **U.S. Cl.** **296/1.1; 296/203.02; 296/194**

(58) **Field of Search** **296/194, 203.02, 296/1.1; 180/684**

(56) **References Cited**

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(57) **ABSTRACT**

In a vehicle front end panel, a horn cover for defining a passage of sound generated by a horn is formed integrally with a panel body to which a front end member such as a radiator is assembled. Further, the panel body and at least a part of the horn cover are integrally molded by resin. Therefore, the horn structure including the horn and the horn cover is readily manufactured in a low cost.

22 Claims, 5 Drawing Sheets

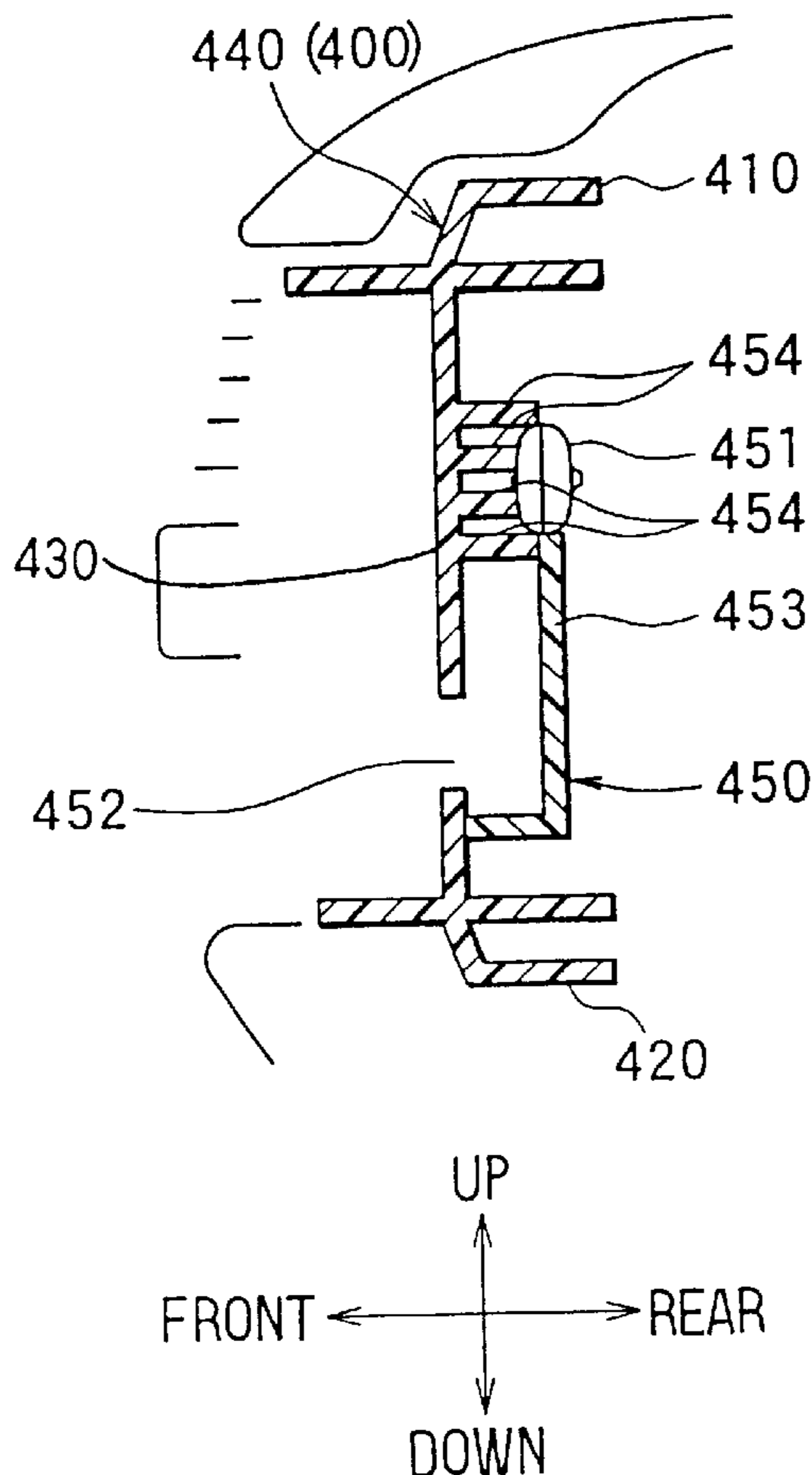


FIG. 1

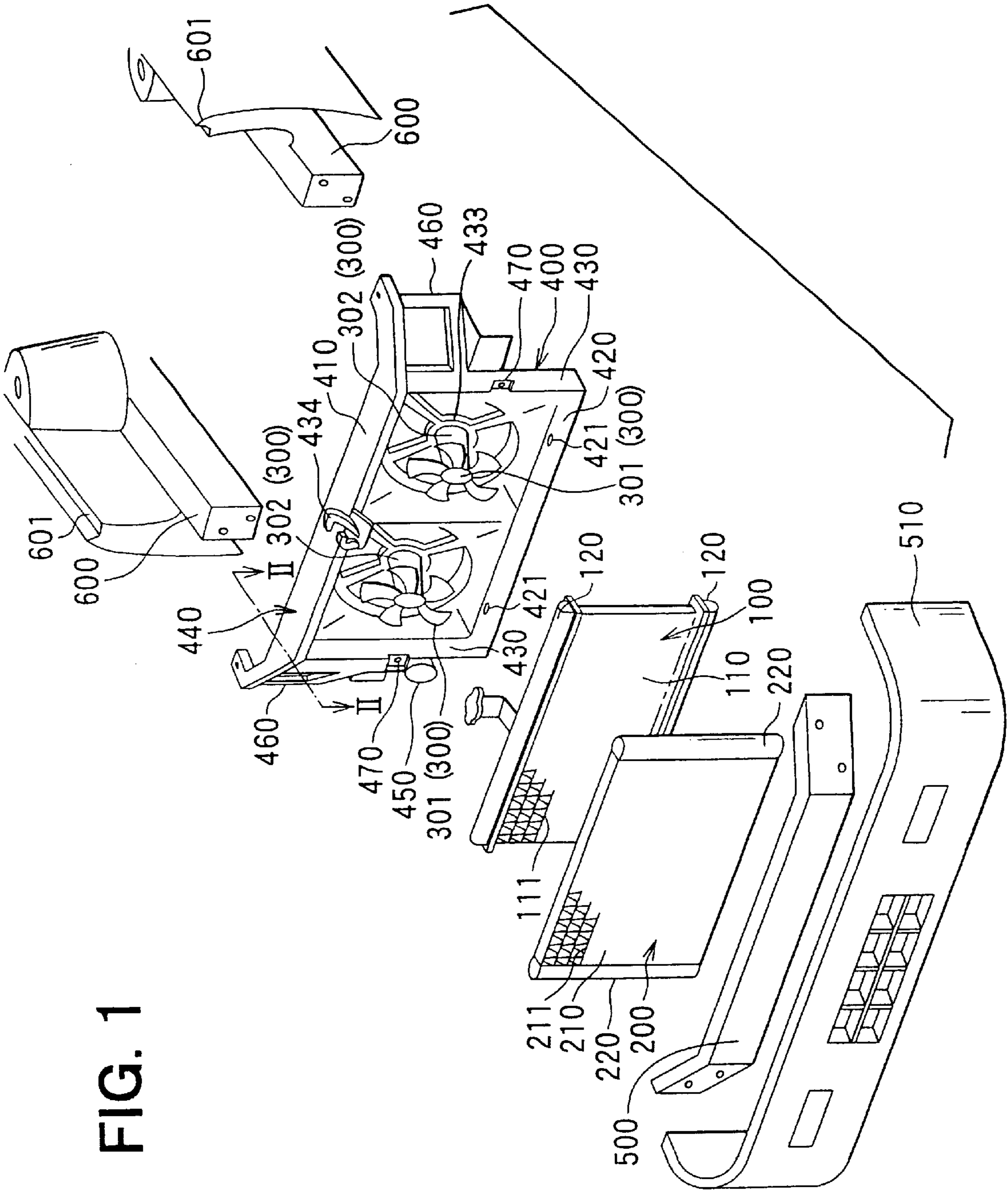


FIG. 2

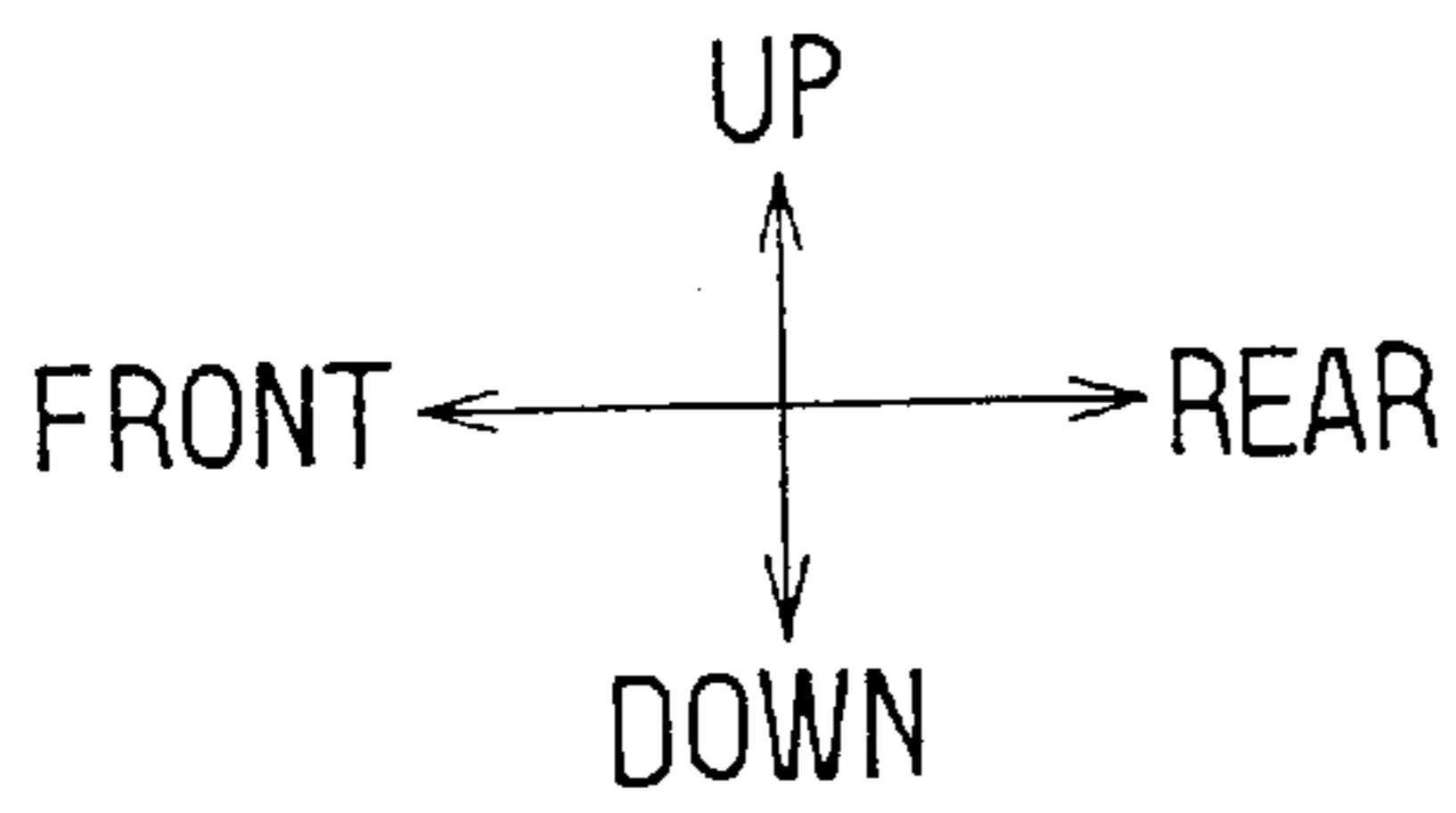
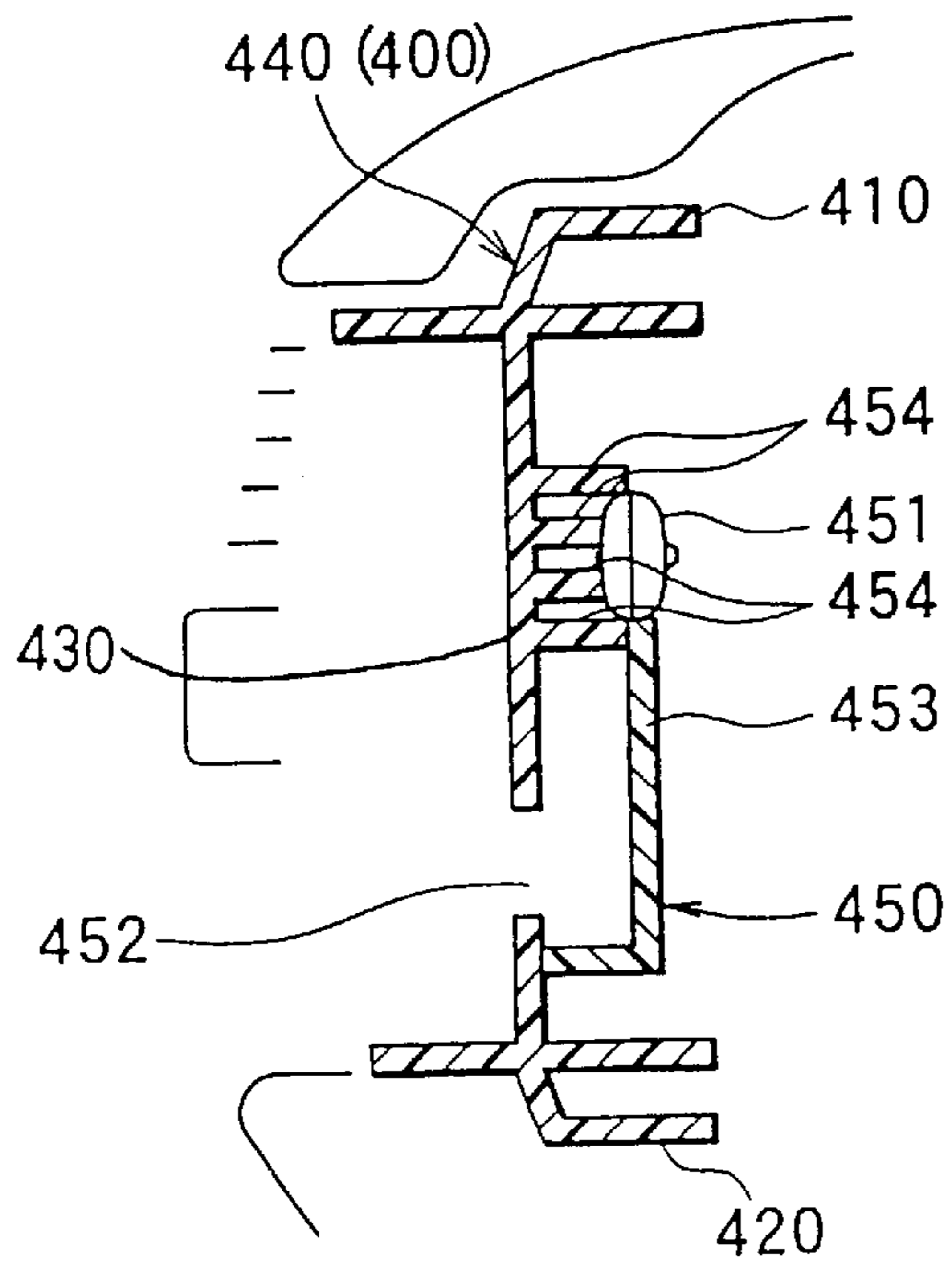


FIG. 3

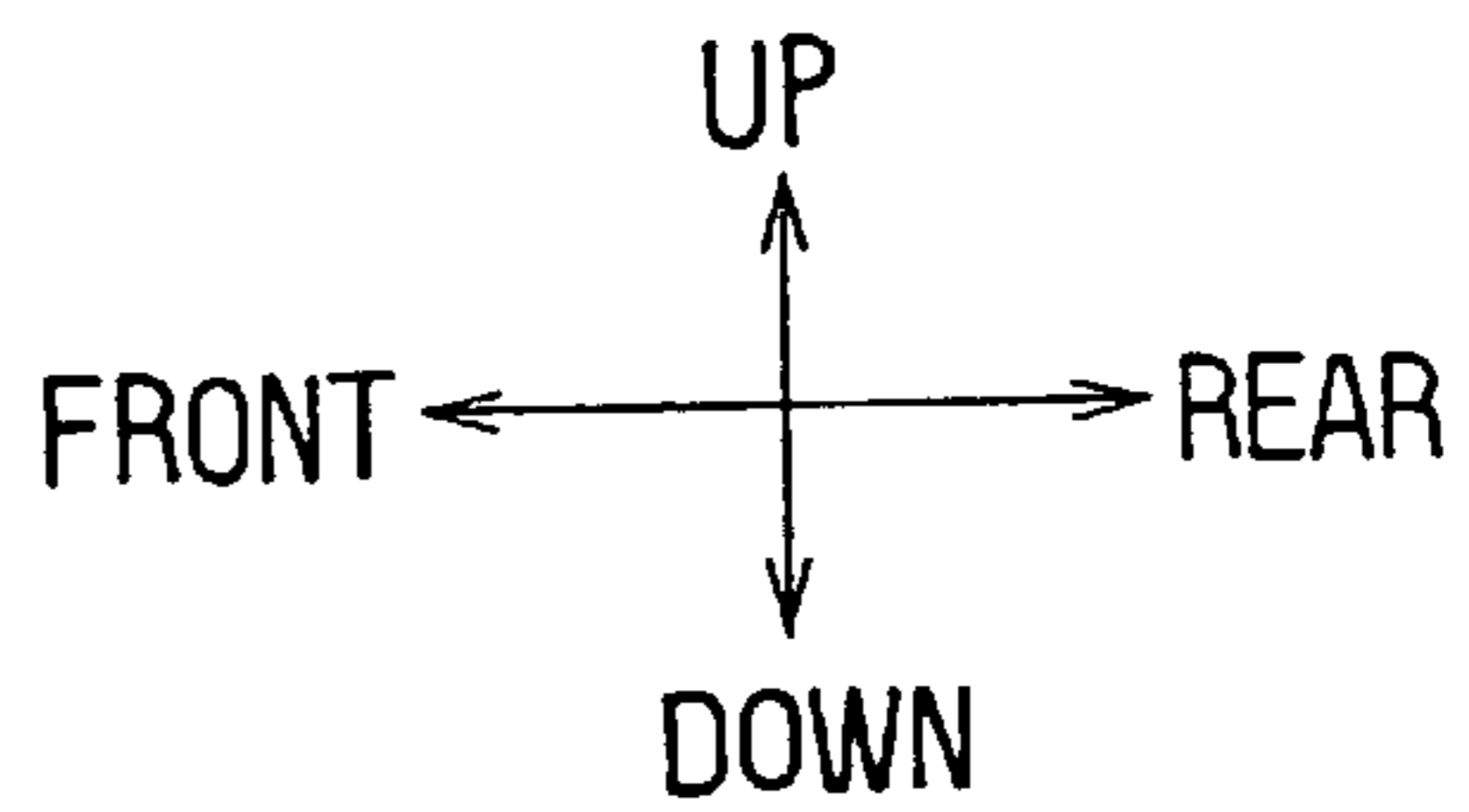
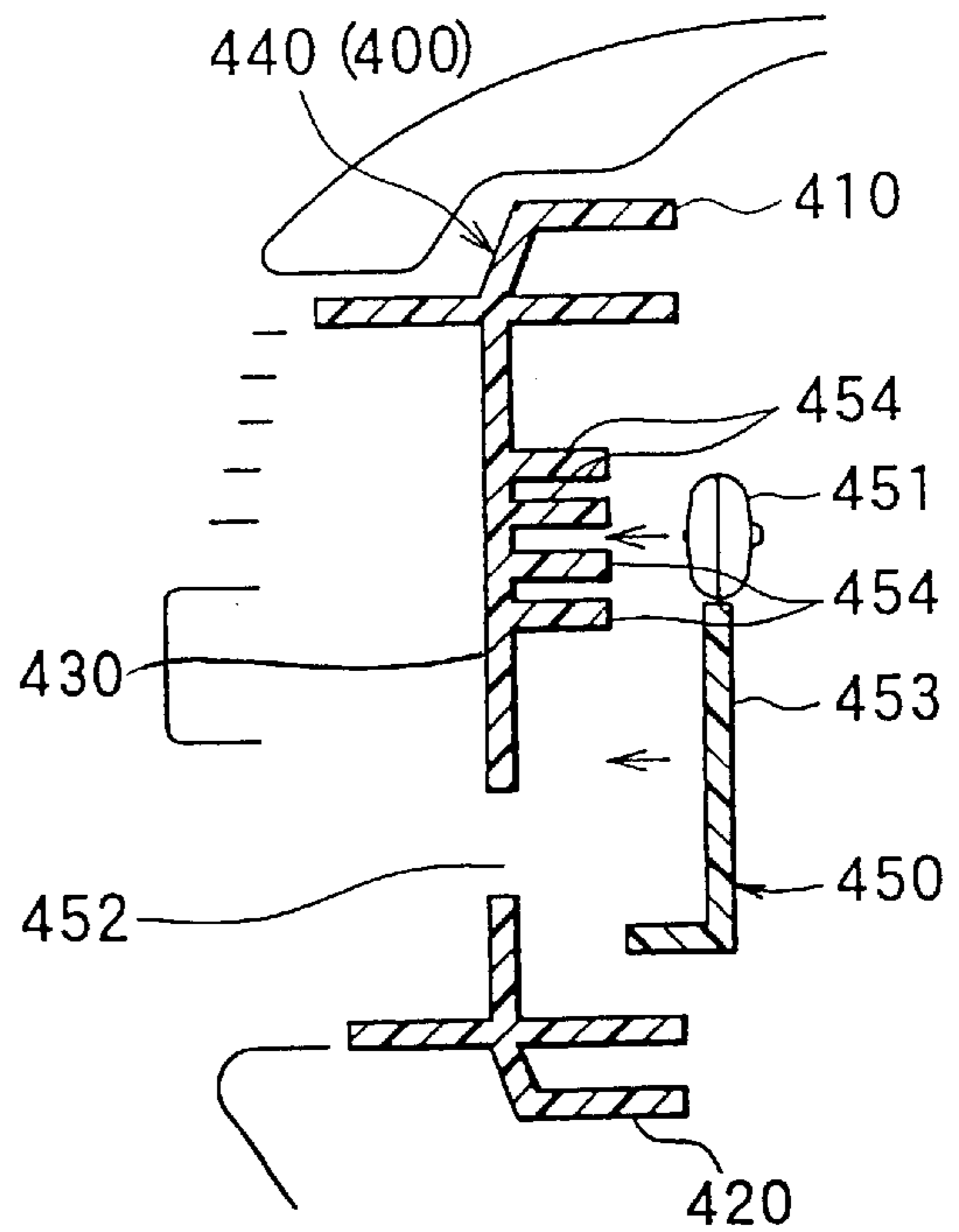


FIG. 4

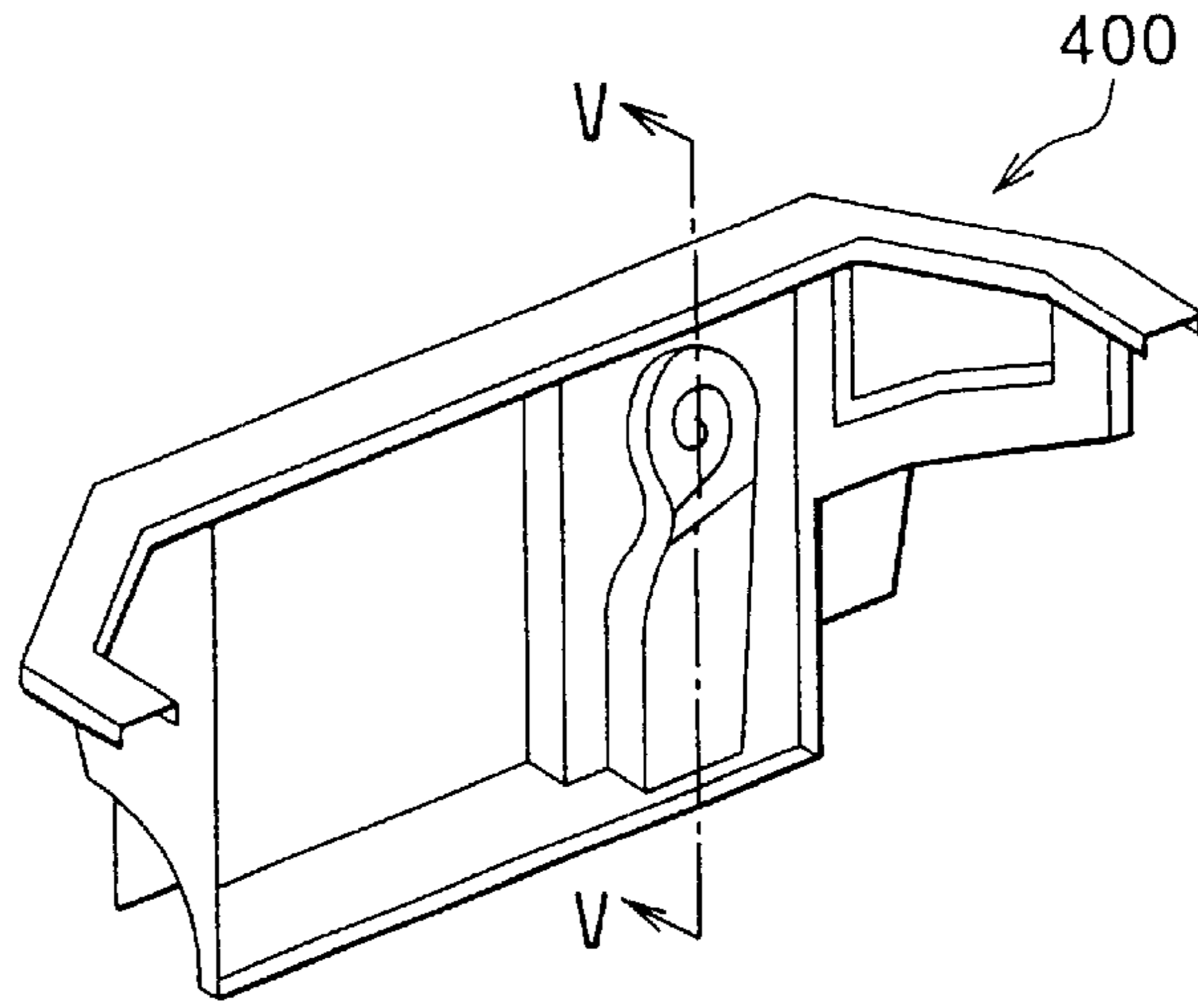


FIG. 5

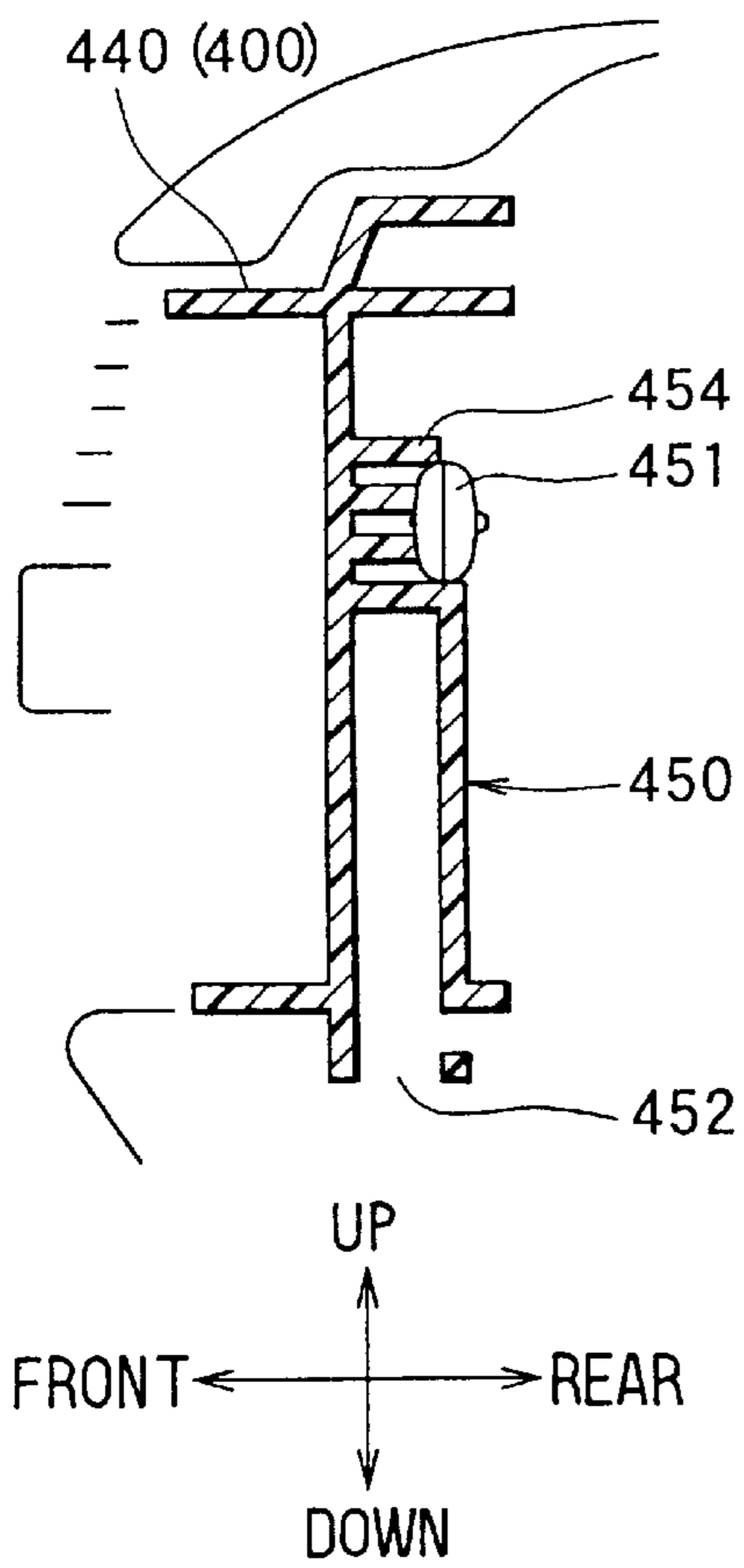


FIG. 6

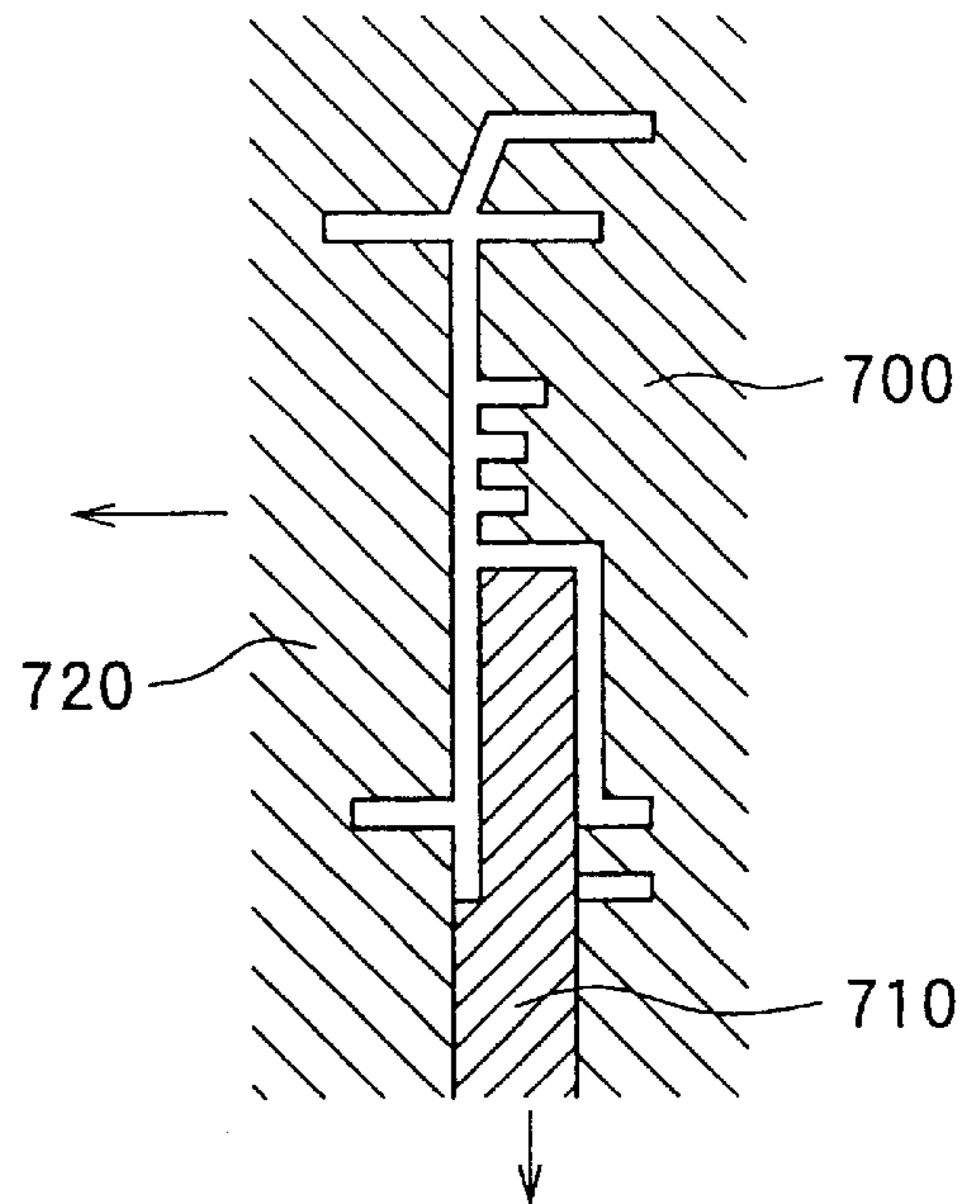


FIG. 7

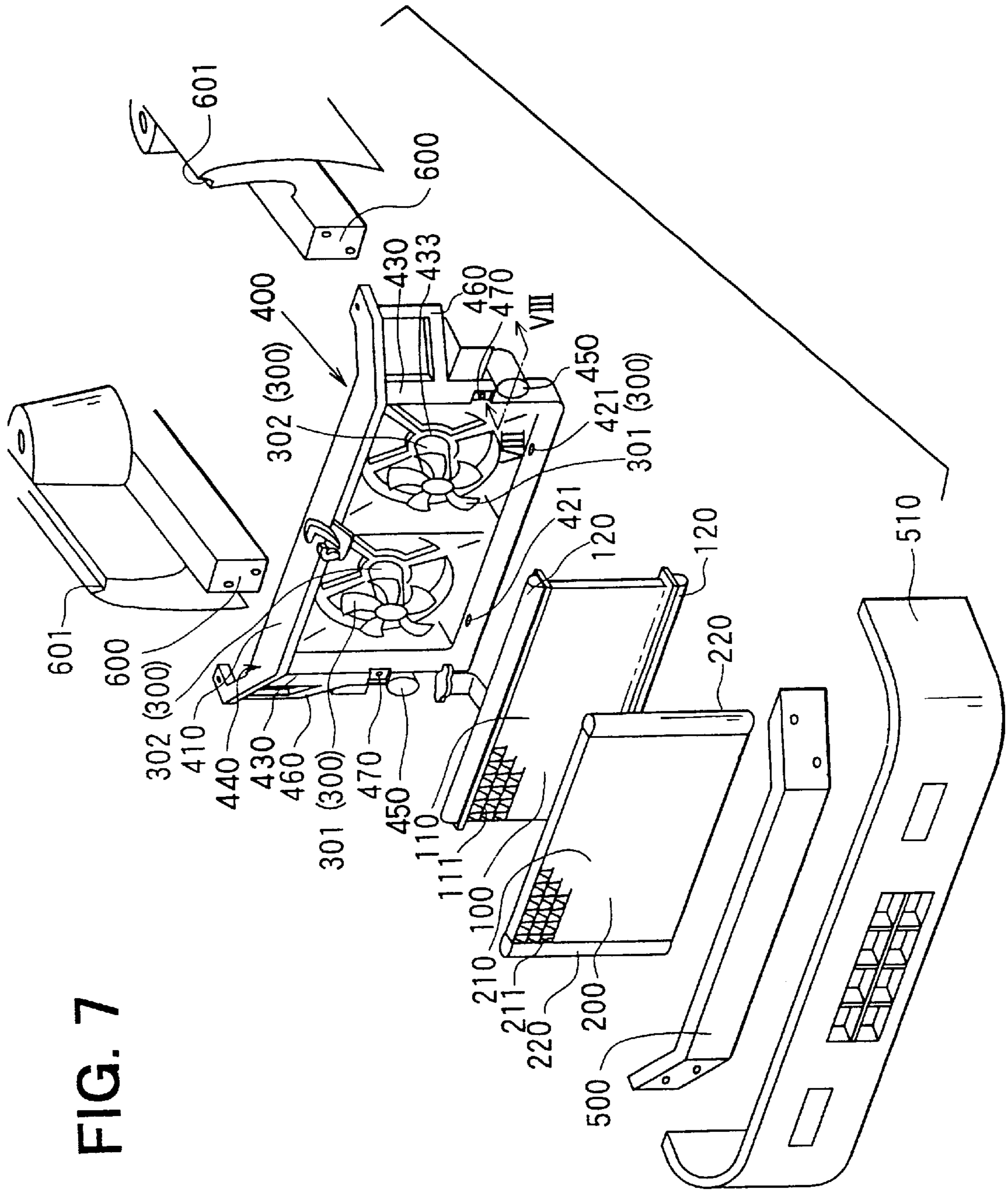


FIG. 8

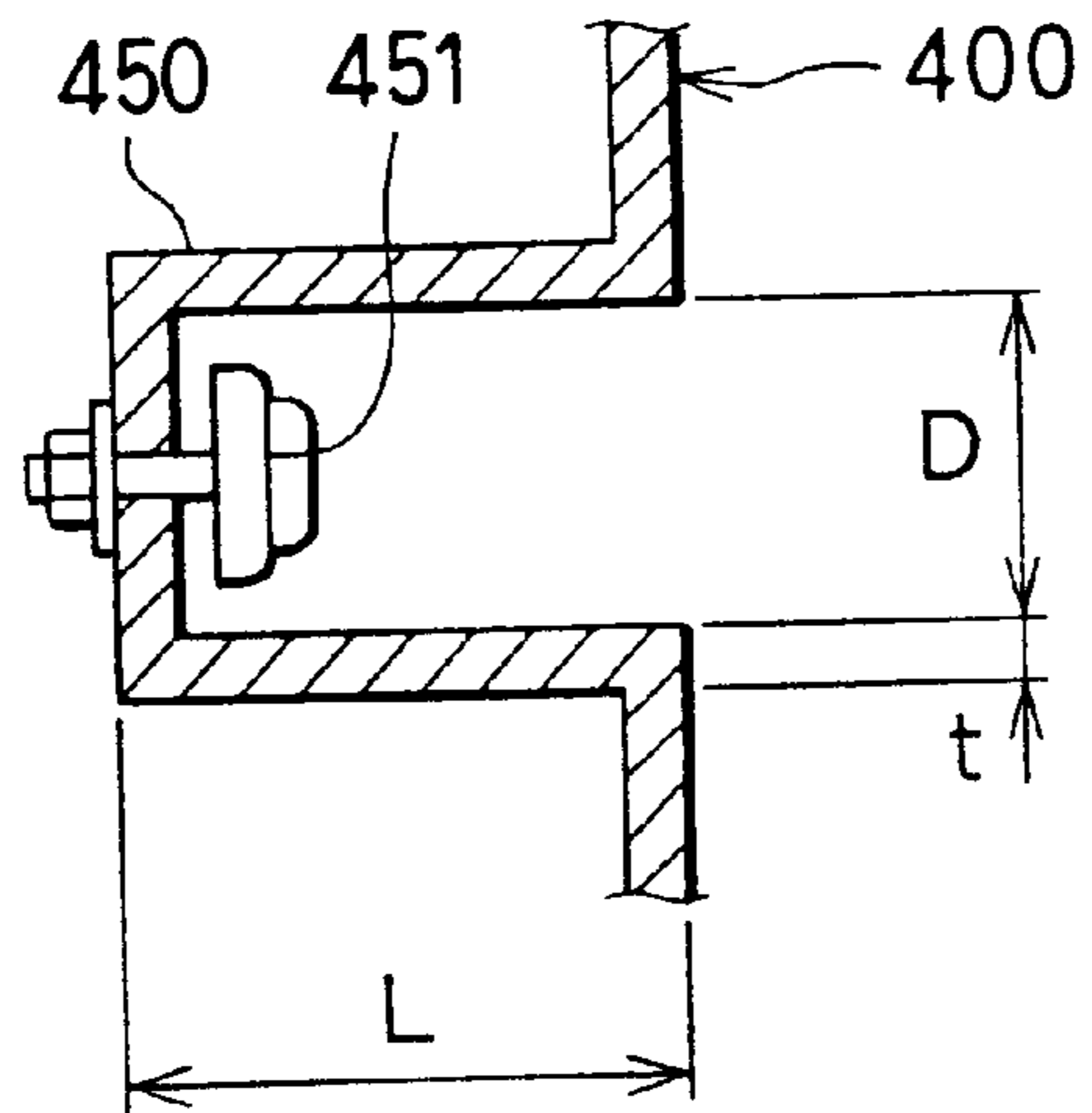
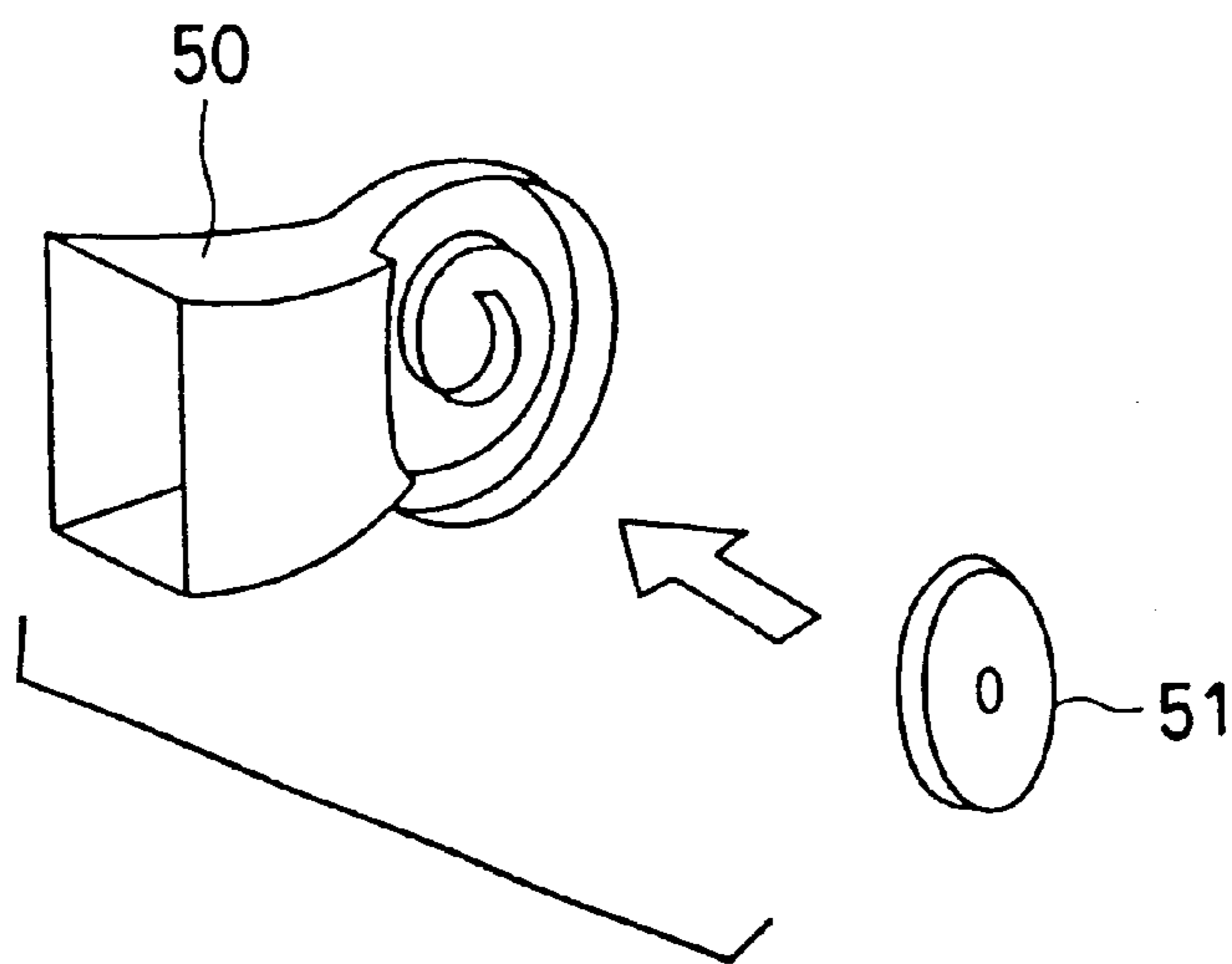


FIG. 9 PRIOR ART



VEHICLE FRONT END PANEL WITH HORN COVER

CROSS-REFERENCE TO RELATED APPLICATION

This application is related to and claims priority from Japanese Patent Applications No. Hei. 11-298496 filed on Oct. 20, 1999, and No. 2000-77832 filed on Mar. 15, 2000, the contents of which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a vehicle front end panel to which a radiator, a headlight, a horn (Klaxon) and the like are assembled.

2. Description of Related Art

As shown in FIG. 9, a conventional trumpet horn structure has a horn cover **50** forming a passage of sound generated by a horn **51**, so that sound effect from the horn **51** is improved by an amplifying effect of the horn cover **50**. However, because the separately formed horn cover **50** is necessary to form the sound passage, the number and manufacturing steps of vehicle front end components are increased, and the cost thereof is increased.

SUMMARY OF THE INVENTION

In view of the foregoing problems, it is an object of the present invention to provide a front end panel with a horn cover which is readily manufactured in a low cost.

According to the present invention, in a vehicle front end panel having a panel body assembled to a vehicle front end side, a horn cover is provided for defining a passage of sound generated by a horn, and the panel body and at least a part of the horn cover are integrally molded to be integrally formed. Therefore, assembling steps of horn structure becomes simple, and the horn structure including the horn and the horn cover is readily manufactured in a low cost.

Preferably, the panel body and the horn cover are integrally molded by resin. Therefore, the vehicle front end panel with the horn cover can be readily manufactured in a low cost.

In the front end panel, the panel body has a rear side portion facing toward a vehicle rear side, and the horn cover is provided so that the horn is positioned at the rear side portion. Therefore, the horn can be protected from rain water or a flying pebble during a vehicle travelling or the like.

Preferably, the horn cover has an outlet opening from which sound generated by the horn is transmitted to an outside through the passage, and the outlet opening is opened in the horn case toward a vehicle front side. Therefore, the effect of sound from the horn can be improved.

More preferably, the outlet opening is opened in the horn case in an axial direction of the passage defined by the horn cover. Therefore, the horn cover can be readily integrally molded with the panel body.

BRIEF DESCRIPTION OF THE DRAWINGS

Additional objects and advantages of the present invention will be more readily apparent from the following detailed description of preferred embodiments when taken together with the accompanying drawings, in which:

FIG. 1 is a disassembled perspective view of a vehicle front end structure with a front end panel according to a first preferred embodiment of the present invention;

FIG. 2 is a cross-sectional view taken along line II—II in FIG. 1;

FIG. 3 is a cross-sectional view corresponding to FIG. 2, before a cover member is assembled;

FIG. 4 is a perspective view showing a rear side surface of a front end panel according to a second preferred embodiment of the present invention;

FIG. 5 is a cross-sectional view taken along line V—V in FIG. 4;

FIG. 6 is a schematic view of a molding die for the front end panel according to the second embodiment;

FIG. 7 is a disassembled perspective view of a vehicle front end structure with a front end panel according to a third preferred embodiment of the present invention;

FIG. 8 is a cross-sectional view taken along line VIII—VIII in FIG. 7; and

FIG. 9 is a perspective view of a conventional trumpet horn structure.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will be described hereinafter with reference to the accompanying drawings.

A first preferred embodiment of the present invention will be now described with reference to 1–3. In the first embodiment, the present invention is typically applied to a vehicle where a radiator for cooling engine-cooling water, a condenser of a refrigerant cycle, and a blower unit for blowing cooling air toward the radiator and the condenser are mounted on a vehicle front end portion.

As shown in FIG. 1, a radiator **100** is disposed at a vehicle rear side of a condenser **200**, and a blower unit **300** composed of a blower fan **301** and an electrical motor **302** for driving the blower fan **301** is disposed at a vehicle rear side of the radiator **100**.

The radiator **100** includes a radiator core **110** having plural radiator tubes **111** through which cooling water flows, and both radiator tanks **120** connected to both ends of each radiator tube **111** in a longitudinal direction of the radiator tubes **111** to communicate with each radiator tube **111**. Similarly, the condenser **200** includes a condenser core **210** having plural condenser tubes **211** through which refrigerant flows, and both condenser tanks **220** connected to both ends of each condenser tube **211** in a longitudinal direction of the condenser tubes **211** to communicate with each condenser tube **211**.

A front end member such as the radiator **100**, the condenser **200** and the blower unit **300** is assembled to a front end panel **400** made of resin. The front end panel **400** includes a panel body **440** and a shroud **433** integrated to each other. The panel body **440** includes an upper beam **410** provided at an upper side to extend in a horizontal direction, a lower beam **420** provided at a lower side to extend in the horizontal direction, and both right and left supporting pillars **430** extending in a vertical direction to connect both the upper and lower beams **410**, **420**. The shroud **433** integrated with the panel body **440** is disposed to support the electrical motor **302** of the blower unit **300**, and to prevent an air suction from a downstream air side of the radiator **100**. A hood lock **434** for fixing an engine hood (bonnet) is attached to the upper beam **410** as shown in FIG. 1.

A bumper **500** (buffer member) made of a metal is covered by a bumper cover **510** made of a resin. The bumper **500** and the front end panel **400** are fixed to vehicle side bodies **600**, **601** by a fastening member such as a bolt.

A horn cover **450** for covering a horn **451** described later is integrally formed with the left supporting pillar **430** to be opened to a vehicle front side, as shown in FIG. 1. Both light attachment portions **460** for attaching headlights (not shown) are formed in the right and left supporting pillars **430**, respectively, to have a rectangular frame shape. Further, sensor attachment portions **470** for attaching sensors such as a vehicle speed sensor and an outside air temperature sensor are right-left symmetrically formed in the supporting pillars **430**.

Further, attachment holes **421** for fixing the radiator **100** are provided in the upper and lower beams **410**, **420**. On the other hand, pin portions (not shown) are provided in the radiator **100** to correspond to the attachment holes **421**. By inserting the pin portions of the radiator **100** into the attachment holes **421** of the front end panel **400**, the radiator **100** is fixed to the front end panel **400**. The condenser **200** is assembled to the radiator **100** to be fixed to the radiator **100** by using a fastening member such as a bolt through a stay.

As shown in FIG. 2, the horn **451** (Klaxon) that is a sound source for generating warning sound is assembled to a position of the panel body **440** of the front end panel **400**, facing toward a vehicle rear side. The horn cover **450** is integrally formed with the panel body **440** of the front end panel **400** at a position facing toward a vehicle rear side to define a passage of sound generated by the horn **451**. The horn cover **450** is formed to have an outlet opening **452** opened toward a vehicle front side, so that a sectional area of the passage of sound is increased from the horn **451** toward the outlet opening **452**.

In the first embodiment, among the horn cover **450**, a wall portion **454** for defining a trumpet passage of sound and a wall part defining the outlet opening **452** are integrally molded with the panel body **440**. Further, as shown in FIG. 3, a cover member **453** made of resin is integrally assembled to the panel body **440** from a vehicle rear side by melt-bonding or by using an adhesive, so that the horn cover **450** is constructed.

According to the first embodiment, because at least a part of the horn cover **450** defining a trumpet sound passage is integrally molded with the panel body **440** by resin, the trumpet horn structure can be readily formed. Therefore, the number of components and the assembling steps of the trumpet horn structure can be decreased, and the trumpet horn structure is manufactured in a low cost. Further, because trumpet sound passage is defined by the horn cover **450**, sound generated by the horn **451** is not directly linearly transmitted to the outlet opening **452**, but is transmitted to the outlet opening **452** to be turned within the horn cover **450**. In the first embodiment, the wall portions **454** are disposed to form a swirl sound passage so that sound generated by the horn **451** is transmitted to the outlet opening **454** after being turned in a swirl like.

In the first embodiment of the present invention, because the horn cover **450** defining the trumpet sound passage is formed integrally with the panel body **440**, the horn **451** can be positioned at a vehicle rear side of the condenser **200**, and is not troubled by rain or an exterior subject such as a flying pebble or the like. Therefore, the horn **451** can be protected without using a seal structure.

As an attachment position of the horn **451**, a position on a rear side portion of the panel body **440** at an approximate center position in the up-down direction is selected. Because the horn **451** is disposed on the rear side position of the panel body **440**, facing a vehicle rear side, the horn **451** can be

protected from rain or an exterior subject such as a flying pebble or the like in a vehicle travelling state. Further, because the horn **451** is disposed in the supporting pillar **430** at an approximate center position in the up-down direction, the upper and lower beams **410**, **420** are used as protection eaves, and the horn **451** can be protected from rain falling from an upper side and from scattering rain water or flying pebble from a road surface.

Further, because the outlet opening **452** of the horn cover **450** is opened toward a vehicle front side, warning sound can be readily transmitted to a vehicle front side regardless of the attachment position of the horn **451**, and the effect of warning sound is improved. The tone quality of the warning sound can be adjusted by adjusting a passage length, a passage sectional area, a change degree of the passage sectional area and the like of the horn cover **450**.

A second preferred embodiment of the present invention will be now described with reference to FIGS. 4-6. In the above-described first embodiment, because the outlet opening **452** is opened in a direction approximately perpendicular to an axial direction of a sound passage defined by the horn cover **450**, all the horn cover **450** is difficult to be integrally molded with the panel body **440** of the front end panel **400**. Therefore, in the above-described first embodiment, the cover member **453** is assembled to the horn cover **450** to form the sound passage.

In the second embodiment, as shown in FIGS. 4 and 5, the outlet opening **452** is opened toward a lower side in the axial direction of the sound passage defined by the horn cover **450**. Therefore, the horn cover **450** can be readily integrally molded with the panel body **440** of the front end panel **400** using molding dies **700-720** shown in FIG. 6. That is, a trumpet sound passage can be readily formed by the integrally molded panel body **440** without assembling a separated member. The molding die **710** shown in FIG. 6 is a slide type.

In the above-described second embodiment, the outlet opening **452** is provided toward a lower side. However, in the second embodiment, if only the outlet opening **452** is opened toward in the axial direction of the sound passage defined by the horn cover **450**, the outlet opening **452** can be opened toward any side, for example, a vehicle side body side or an upper side of the vehicle.

A third preferred embodiment of the present invention will be now described with reference to FIGS. 7 and 8. In the third embodiment, components similar to those of the above-described first embodiment are indicated with the same reference number. In the above-described first and second embodiment, the horn cover **450** and the horn **451** are provided to form the swirl sound passage. However, in the third embodiment, the horn cover **450** is formed into a cylinder shape having a closed bottom surface at a vehicle rear side, and horn **451** is attached to the bottom surface. Therefore, a tone quality and a sound pressure of the warning sound generated by the horn **451** are readily adjusted by adjusting resonance frequency of the horn cover **450**. In the third embodiment, the resonance frequency of the horn cover **450** is adjusted by adjusting an inner diameter D of the horn cover **450**, a height L (i.e., the dimension from an opened surface to the bottom surface) of the horn cover **450** and a wall thickness t of the horn cover **450**, as shown in FIG. 8.

In the third embodiment, as shown in FIG. 8, the horn cover **450** is formed integrally with the front end panel **400**. That is, the horn cover **450** is integrally molded with the panel body **440** of the front end panel **400**. Therefore, by

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changing a shape of a part of a molding die, forming the horn cover **450**, the inner diameter D , the height L and the wall thickness t of the horn cover **450** can be readily changed, so that the tone quality and the sound pressure of the warning sound generated by the horn **451** can be readily adjusted.

In the third embodiment, as shown in FIG. **8**, the horn cover **450** is formed integrally with the front end panel **400**. That is, the horn cover **450** is integrally molded with the panel body **440** of the front end panel **400**. Therefore, by changing a shape of a part of a molding die, forming the horn cover **440**, the inner diameter D , the height L and the wall thickness t of the horn cover **450** can be readily changed, so that the tone quality and the sound pressure of the warning sound generated by the horn **451** can be readily adjusted.

Further, in the third embodiment, as shown in FIG. **7**, similarly to the light attachment portions **460** and the sensor attachment portions **470** described in the embodiment, both the horn covers **450** are integrally formed with the right and left supporting pillars **430**, respectively, to be right and left symmetrical. Generally, the horn **451** and the sensors are provided to a driver's seat side at which a damage of the horn **451** and the sensors are difficult to be received. In the third embodiment, because both the horn covers **450** and both the sensor attachment portions **470** are right-left symmetrically formed integrally with the front end panel **400**, the front end panel **400** can be used for a vehicle having a right steering wheel and for a vehicle having a left steering wheel. Accordingly, the attachment positions of the horn **451** and the sensors are readily changed relative to different positions of the steering wheel in a vehicle.

Further, in the front end panel **400**, the upper beam **410**, the lower beam **420**, the right and left supporting pillars **430**, the shroud **433**, the horn covers **450**, the light attachment portions **460** and the like are integrally formed by resin, at the same time. Therefore, the front end panel **400** can be readily manufactured in a low cost. In the third embodiment, the other parts are similar to those of the above-described first embodiment.

Although the present invention has been fully described in connection with the preferred embodiments thereof with reference to the accompanying drawings, it is to be noted that various changes and modifications will become apparent to those skilled in the art.

For example, in the above-described embodiments of the present invention, the front end panel **400** is made of a resin; however, may be made of the other material such as a metal. In the above-described embodiments, the front end panel **400** and at least a part of the horn cover **450** are integrally molded by resin. However, the front end panel **400** and the horn cover **450** may be integrally bonded by a melting or an adhesive, after being separately formed from each other.

In the above-described third embodiment of the present invention, the horn cover **450** is formed into a cylinder shape; however, may be formed into the other shape such as a pipe like. In the above-described third embodiment of the present invention, both the horn covers **450** are right-left symmetrically disposed in the panel body **440**; however, may be disposed at the other positions in the panel body **440**.

Such changes and modifications are to be understood as being within the scope of the present invention as defined by the appended claims.

What is claimed is:

1. A front end panel of a vehicle comprising:

a panel body assembled to a vehicle front end side, to which a front end member mounted on the vehicle front end side is attached; and

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a horn cover member, to which a horn is attached, wherein:

said panel body has a wall member integral with said horn cover member; and

said wall member and said horn cover member are disposed to construct a horn cover defining a passage of sound generated by said horn.

2. The front end panel according to claim **1**, wherein said wall member and at least a part of said horn cover member are integrally molded by resin.

3. The front end panel according to claim **1**, wherein:

said horn cover has an outlet opening from which sound generated by said horn is transmitted to an outside through said passage; and

said outlet opening is provided in said wall member to be opened toward a vehicle front side.

4. The front end panel according to claim **1**, wherein:

said horn cover has an outlet opening from which sound generated by said horn is transmitted to an outside through said passage; and

said outlet opening is opened in said horn case in an axial direction of said passage defined by said horn cover.

5. The front end panel according to claim **1**, wherein said passage of said horn cover is provided so that sound generated by said horn is transmitted to an outside after being turned within said horn cover.

6. The front end panel according to claim **1**, wherein said passage of sound has a swirl shaped part.

7. The front end panel according to claim **1**, wherein said passage of sound is provided in such a manner that a sectional area is increased from said horn toward an outlet opening of said horn cover.

8. The front end panel according to claim **1**, wherein said horn cover is formed into a cylinder shape.

9. The front end panel according to claim **8**, wherein:

said horn is attached to a bottom surface of the cylinder shape of said horn cover, at a vehicle rear side; and

said horn cover has an opening opened toward a vehicle front side.

10. The front end panel according to claim **1**, wherein both said horn covers are provided in said panel body at both right and left positions to be right-left symmetrical in the vehicle.

11. The front end panel according to claim **1**, wherein said front end member includes at least a radiator for cooling an engine-cooling water.

12. The front end panel according to claim **1**, wherein:

said panel body includes upper beam member extending horizontally at a vehicle upper side, a lower beam member extending horizontally at a vehicle lower side, and right and left supporting pillars extending vertically to connect said upper beam member and said lower beam member;

said front end member is attached to said upper beam member and said lower beam member; and

said wall member is one of said right and left supporting pillars.

13. The front end panel according to claim **1**, wherein said passage defined by said horn cover has a trumpet shape.

14. The front end panel according to claim **1**, wherein:

said horn cover member is disposed at a vehicle rear side of said wall member of said panel body; and

said horn is disposed at a vehicle rear side position in the horn cover.

15. The front end panel according to claim 1, wherein:
 said horn cover member includes a plurality of protrusion
 walls protruding from said wall member of said panel
 body approximately vertically relative to a wall surface
 of said wall member; and 5
 said horn is disposed on protrusion top sides of said
 protrusion walls.
16. The front end panel according to claim 15, wherein
 said protrusion walls protrudes toward a vehicle rear side. 10
17. The front end panel according to claim 15, wherein:
 said horn cover member further includes a plate member
 having a plate portion approximately parallel to said
 wall surface of said wall member;
 one end of said plate member is connected to one pro- 15
 trusion end of said protrusion walls, at one side of said
 horn; and
 the other end of said plate member is coupled to the wall
 member.
18. The front end panel according to claim 17, wherein 20
 said plate portion is disposed to protrude from said one
 protrusion end of said protrusion walls.
19. The front end panel according to claim 1, wherein:
 said horn cover has an outlet opening from which sound
 generated by said horn is transmitted to an outside 25
 through said passage;
 said passage of said horn cover has a length from said
 horn to said outlet opening, and a sectional area; and
 said passage is provided in such a manner that a tone color 30
 of sound generated by said horn is adjusted by the
 length and the sectional area of said passage.

20. A front end structure of a vehicle, comprising:
 a front end member including at least a radiator, said front
 end member being mounted on the vehicle at a vehicle
 front end side;
 a front end panel to which said front end member is
 assembled;
 a horn for generating a sound; and
 a horn cover member, to which said horn is attached,
 wherein:
 said front end panel has a wall member integral with
 said horn cover member; and
 said wall member and said horn cover member are
 disposed to construct a horn cover defining a passage
 of sound generated by said horn.
21. The front end structure according to claim 20, wherein
 said wall member of said front end panel and at least a part
 of said horn cover member are integrally molded.
22. A front end panel of a vehicle, said front end panel
 comprising:
 a panel body assembled to a vehicle front end side;
 a horn cover defining a sound passage, said panel body
 and a portion of said horn cover forming a single piece
 homogeneous structure;
 a horn attached to said horn cover, said horn operable to
 generate a sound directed towards said sound passage.

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